

boiling point constant 1745.4246 (C_1 in equation 1). Subtracting means 50 subtracts the signal provided by summing means 33 from the signal provided by summing means 33 to provide a signal to a multiplier 51. Signal KV from viscosity analyzer is applied to a natural log function generator 52 which provides a signal corresponding to the term $\ln KV$ in equation 1. Multiplier 51 multiplies the signals from function generator 52 and subtracting means 51 to provide signal E_1 corresponding to 30% boiling point of the crude oil in line 1.

A signal E_2 , corresponding to the 50% boiling point of the crude oil, is also provided as follows. Signal S from sulfur analyzer 15 is multiplied with voltage V_8 , corresponding to the 50% boiling point constant 278.5749 (C_5 in equation 1), by a multiplier 65 to provide a product signal. The signal from function generator 23 is multiplied with voltage V_9 , corresponding to the 50% boiling point constant 1129.0759 (C_2 in equation 1), by a multiplier 58 to provide a product signal to summing means 60.

The product signal from multiplier 29, corresponding to the term $[\ln(IR \times C_3)]S$, is applied to a multiplier 63 where it is multiplied with voltage V_{10} , corresponding to the 50% boiling point constant 69.0106 (C_7 in equation 1). A multiplier 64 multiplies the signal from function generator 45 with voltage V_{11} , corresponding to the 50% boiling point constant 541.8975 (C_4 in equation 1) to provide a signal. Summing means 60 sums the signals provided by multipliers 58, 63 and 64, to provide a sum signal.

Multipliers 65, 67 multiply signal S and the signal from multiplier 30, respectively, with voltages V_8 and V_{12} , respectively, to provide product signals to summing means 69 where they are summed with voltage V_{13} to provide a sum signal. Voltages V_{12} , V_{13} correspond to the 50% boiling point constants 141.0175 and 3926.6512, respectively (C_6 and C_1 , respectively, in equation 1). Summing means 69 effectively sums the negative terms of equation 1. Subtracting means 70 subtracts the signal provided by summing means 69 from the signal provided by summing means 60 to provide a signal to a multiplier 75. Multiplier 75 multiplies the signal from subtracting means 70 with the signal from function generator 52 to provide signal E_2 corresponding to the 50% boiling point of the crude oil in line 1.

The systems hereinbefore described provide an on-line determination of at least one boiling point property of crude oil. It can provide as many boiling point properties simultaneously as desired.

What is claimed is:

1. A boiling point analyzer for on-line determination of at least one boiling point property of crude oil flowing in a line comprising means for sampling the crude oil and providing samples, viscosity analyzing means receiving samples of the crude oil and providing a signal KV corresponding to the kinematic viscosity of the crude oil, infrared analyzing means connected to the

sampling means and receiving a sample for providing a signal IR corresponding to the infrared absorption of the crude oil at a predetermined wavelength, ultraviolet analyzing means connected to the sampling means and receiving a sample for providing a signal UV corresponding to the ultraviolet absorption of the crude oil at another predetermined wavelength, sulfur analyzing means connected to the sampling means and receiving a sample for providing a signal S corresponding to the sulfur content of the crude oil, and boiling point signal means connected to all the analyzing means for providing a boiling point signal corresponding to a boiling point property of the crude oil.

2. A boiling point analyzer as described in claim 1 in which the boiling point signal means provides the boiling point signal in accordance with the following equation:

$$M\%BP = \{-C_1 + C_2[\ln(IR \times C_3)] + C_4[\ln UV] - C_5 \\ S - C_6[\ln(IR \times C_3)][\ln UV] + C_7[\ln(IR \times C_3)]S\} \ln KV$$

where M%BP is a particular boiling point property of the crude oil, IR is the infrared absorption of the crude oil at the one predetermined wavelength, UV is the ultraviolet absorption of the crude oil at another predetermined wavelength, S is the sulfur content of the crude oil, KV is the kinematic viscosity of the crude oil, and C_1 through C_7 are constants.

3. A boiling point analyzer as described in claim 2 in which M%BP is the 30% boiling point and the constants C_1 through C_7 have the values of 1745.4246, 525.6163, 1000, 254.8026, 144.6291, 65.6417 and 30.2110, respectively.

4. A boiling point analyzer as described in claim 2 in which M%BP is the 50% boiling point and the constants C_1 through C_7 have values of 3926.6512, 1129.0759, 1000, 541.8975, 278.5749, 141.0175 and 69.0106, respectively.

5. A boiling point analyzer as described in claim 2 further comprises second boiling point signal means for providing a second boiling point signal corresponding to a second boiling point property of the crude oil in accordance with the equation and in which the constants C_1 through C_7 have one set of values for the first boiling point property and another set of values for the second boiling point property.

6. A boiling point analyzer described in claim 5 in which one of the boiling point signal means provides a signal corresponding to the 30% boiling point of the crude oil as its boiling point signal in accordance with the equation where the constants C_1 through C_7 have values of 1745.4246, 525.6163, 1000, 254.8026, 144.6291, 65.6417 and 30.2110, respectively, and the other boiling point signal means provides a signal corresponding to the 50% boiling point as its boiling point signal in accordance with the equation where C_1 through C_7 have values of 3926.6512, 1129.0759, 1000, 541.8975, 278.5749, 141.0175 and 69.0106, respectively.

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